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ABSTRACT

Cost-effectiveness/benefit analysis is an analytical technique for assessing outputs of educational programs in relation to the program objectives and the associated program costs. It combines the two concepts of cost-effectiveness analysis and cost-benefit analysis into a comprehensive model. The cost-effectiveness/benefit analysis model has been developed to include the three major components of determining program objectives and target goals in measurable terms, assessing short and long-range program outputs, and analyzing program costs. The relationships of the three major components generate three kinds of measures. These are program effectiveness, cost efficiency, and management performance measures for educational programs. The cost-effectiveness/benefit measures can be used in answering the three related questions. (1) How effective are educational programs? (2) How efficient are the programs? and (3) Do the programs perform in an effective and efficient manner? The cost-effectiveness/benefit model can be integrated into emerging management systems such as accountability systems, planning, programming, budgeting systems, and management by objectives systems. It provides analytical techniques and quantitative measures necessary in developing management systems. The conceptual and technical procedures as developed in the cost-effectiveness/benefit analysis model can be applied to planning, implementing, and evaluating educational programs and to improving a formulation of management systems for educational program operation. (Author/JM)

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A COST-EFFECTIVENESS/BENEFIT ANALYSIS MODEL FOR
IMPROVING EDUCATIONAL PROGRAM MANAGEMENT

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A COST-EFFECTIVENESS/BENEFIT ANALYSIS MODEL FOR IMPROVING EDUCATIONAL PROGRAM MANAGEMENT

In recent years, management science has developed management systems such as accountability, planning-programming-budgeting (PPB), and management by objectives (MBO), and it has increased its efforts to develop analytical techniques which can evaluate program effectiveness and benefits and determine the most efficient use of resources. These systems are helpful in the management of educational programs. Although each of the approaches emphasizes specification of program objectives, measurement of objective attainments, and efficient utilization of resources, few attempts have been made to provide applicable formulas and quantitative measures for assessing educational and managerial performances.

In an effort to alleviate this problem, the author and his associate developed a cost-effectiveness analysis model (Kim & Harris, 1976) for secondary vocational programs. To combine the cost-benefit analysis concept into the previously developed cost-effectiveness analysis model, a cost-effectiveness/benefit analysis model and administrator's manual have been developed for postsecondary vocational programs (Kim, 1977).

This paper presents a conceptual model which will be applicable to analyzing the cost-effectiveness and/or cost-benefit of educational programs in terms of program effectiveness, cost efficiency, and management performance. After defining the cost-effectiveness/benefit analysis concept and the educational system as a production process, it will explain four major components and three kinds of measures which are conceptualized within the model. Then the integration of the model and resulting measures into emerging management systems will be discussed for improving educational program management.

Definition of Cost-Effectiveness/Benefit Analysis

The concept of cost-effectiveness or cost-benefit analysis has been viewed in a number of different ways. Quade (1967) defines cost-effectiveness analysis in a broad sense as an "analytical study designed to assist a decision-maker in identifying a preferred choice among possible alternatives," and narrowly, it is a "comparison of alternative courses of action in terms of their costs and their effectiveness in attaining some specific objectives" (pp. 1-2).

Cost-effectiveness analysis is referred to as systematic examination and comparison of alternative courses of action on the basis of the assessment of both (1) direct and indirect costs, and (2) gains and benefits (Benson, 1968, p. 257). Knezevich (1973) defines a cost-effectiveness analysis as a "systematic examination of an alternative in terms of its advantages, as measured by a fixed outcome; and disadvantages, as measured by the economic cost" (p. 326). In analyzing the cost and effectiveness of educational programs, Forbes (1974) defines effectiveness as "a measure of the achievement of program objectives" (p. 21).

Cost-benefit analysis is defined as "systematic examination of an alternative as determined by the economic value (advantages) of the alternative as related to its economic costs (disadvantages)" (Knezevich, 1973, p. 326). As an economic analysis for assessing alternative programs, cost-benefit analysis is directed toward comparing the cost and the resulting monetary benefits of programs. By assessing both inputs and outputs in monetary units, the analysis provides three criteria: (1) the expected net present value, (2) the benefit-cost ratio, and (3) the expected internal rate of return (Stromsdorfer, 1972, p. 12).

In general, cost-effectiveness analysis and cost-benefit analysis are distinguished from one another by their different measures of effectiveness and benefit, even though they both relate their measures to the common denominator of costs. Whereas the measure of effectiveness is not the same as the measure of costs, the measure of benefits is the same as the measure of costs (Knezevich, 1973, p. 326; Forbes, 1974, p. 21; Levin, 1975, pp. 92-93; Rossmiller & Geske, 1976, p. 489; Kim & Harris, 1976, pp. 8-9). In other words, effectiveness is measured by the degree of achieved program objectives, while benefit is measured in a monetary unit.

However, when viewing effectiveness and benefits as output measures against costs for educational programs, both cost-effectiveness and cost-benefit analyses may be combined into the input-output framework. At the same time, two approaches can be employed in analyzing the cost and effectiveness and/or benefits of existing and/or new programs. From this point of view, a cost-effectiveness and/or benefit analysis is defined as an analytical technique for assessing the outputs of educational programs, in relation to their specified program objectives and against the costs of those programs.

The Educational System as a Production Process

The educational system and its educational production process can be explained by a systems model which consists of: (1) inputs to the system, (2) outputs of the system, and (3) operation of the system.

Inputs to the System. External factors to the educational system influence the nature of educational goals, program development, and the level of funding in the field of education. A community's population characteristics, values, expectations, and manpower needs strongly influence

the outcomes of schooling. The community's economic resources and its willingness to support education affect the amount and quality of human and material resources available to operating educational programs. These external inputs may be summarized as the community demand and support for the educational system.

The significant external input to the educational system is students (Rossmiller & Geske, 1976, p. 496). The U.S. Office of Education suggests that student characteristics be classified into two categories: (1) regular students, and (2) special students who are gifted, mentally retarded, physically handicapped, emotionally disturbed, or culturally disadvantaged (Handbook II, 1973, p. 24). In addition, students can be characterized according to: (1) sex, age, and ethnic identity, (2) individual needs for education, and (3) the socio-economic status of a student's family such as parents' education and annual incomes.

Outputs of the System. The outputs of an educational system may be classified in a number of different ways, for example short-range and long-range, cognitive and noncognitive, or monetary and nonmonetary (Rossmiller & Geske, 1976, p. 499). Some others classify the outputs into the effects on the student, school, and community (Abt, 1969, p. 677).

Short-range outputs may be described in terms of student achievements, manual skills, program completion, and/or graduation. For those concerned with the community effects, long-range outputs may indicate the impact of the system upon the individual and social incomes, and upon the community's productive life such as participation in governmental affairs, crime rates, and number of public assistance recipients (Rossmiller & Geske, 1976, p. 500).

Operation of the System. The system operates to achieve the mission and goals assigned to its educational programs within a public policy framework. The federal legislatures (i.e., Education Acts and Amendments) define aims, priorities and controls for educational programs. Based on the federal and state legislative authority, a state may control educational policy for the planning, implementing and evaluation of the educational programs. At the institutional level, the community supplements the state's policy controls by establishing its own objectives and goals through the board of trustees. The academic institute has to set forth objectives and establish the relative importance of goals and priorities for the educational programs.

To achieve the institutional goals and program objectives, academic administrators must organize meaningful programs and relevant learning activities, recruit professional personnel, and secure material resources such as the physical plant, instructional equipment, and classroom and laboratory facilities. A major task of educational administrators is to identify the most appropriate manner in which the available student inputs, and human and material resources may be combined to achieve program goals and objectives while operating within the constraints imposed by the external factors.

In order to utilize the available resources effectively and efficiently, the administrative personnel must be familiar with various resource mixes as well as the community that the institute serves. They can operate educational programs with the available resources to enhance student training by using the cost-effectiveness/benefit analysis techniques as well as the emerging management systems.

A Cost-Effectiveness/Benefit Analysis Model

A comprehensive model has been conceptualized for the cost-effectiveness/benefit analysis of educational programs within the input-output framework. The model includes: (1) educational programs for analysis, (2) program objectives and target goals, (3) program outputs, and (4) program costs, student costs; and it generates three kinds of cost-effectiveness/benefit measures (see Figure 1).

Classification of Educational Programs. Educational programs can be classified by school level, and/or curriculum in a systematic way. The U.S. Office of Education (1970) suggests a set of 22 curricula areas for elementary, secondary, junior college, and adult education programs. Each program area is subcategorized into a coding system (pp. 107-152). According to the Higher Education General Information Survey (HEGIS), instructional programs in higher education are divided into two sections: section one classifies 24 academic disciplines, and section two classifies five technological and occupational disciplines (Gulko, 1972). Each disciplinary program is also subcategorized.

Accordingly, each instructional program or subprogram is considered as a unit for analysis in the model. In other words, the model is concerned with cost-effectiveness/benefit analysis of all instructional programs independently or collectively within the school or across school systems.

Program Objectives/Target Goals. Instructional programs illuminate objectives and the resources and activities to achieve the objectives. Program objectives may be defined by the operating thrusts of school administrators on the basis of the community demands and student characteristics along with the program's needs and requirements for the local district as well as statewide goals and objectives.

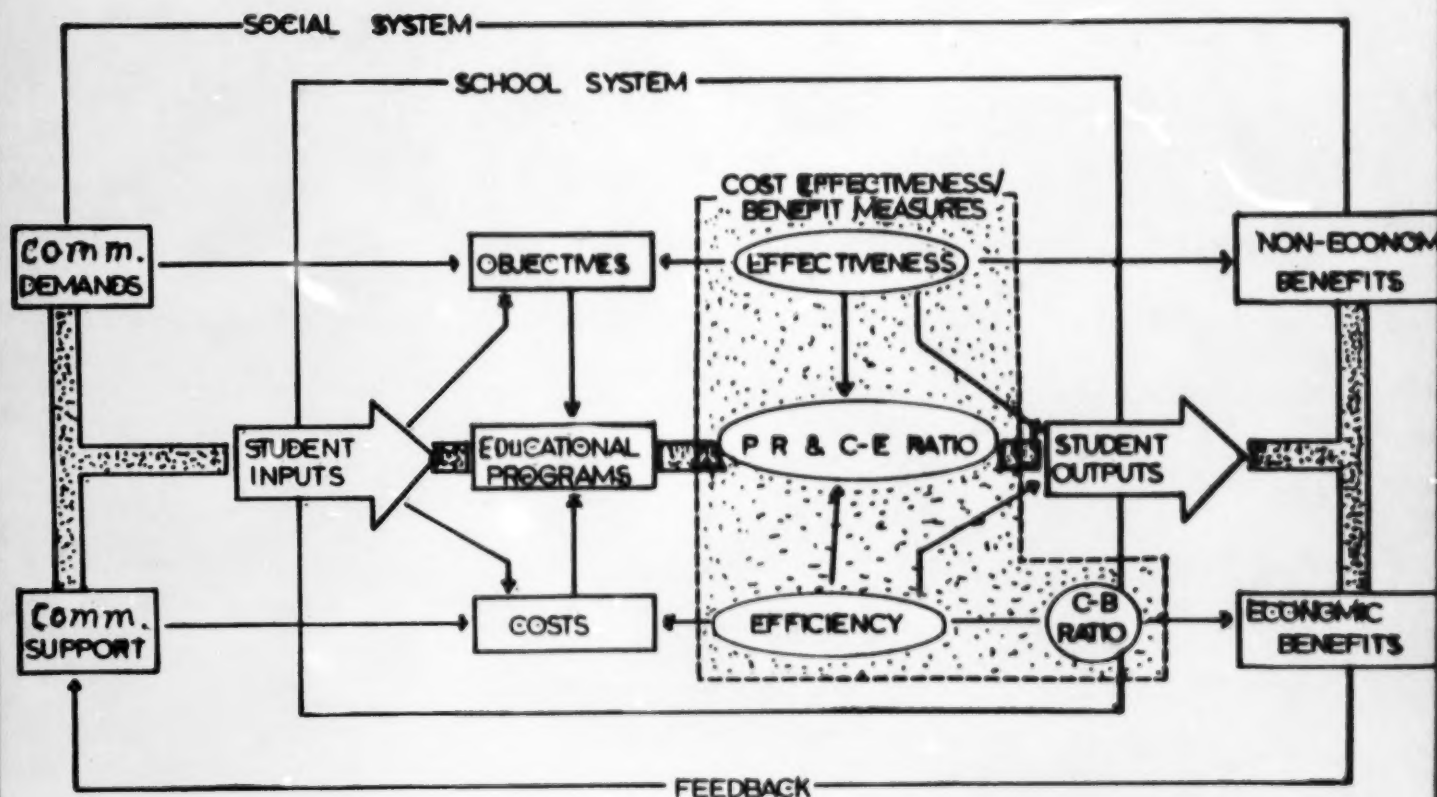


Figure 1

A Cost-Effectiveness/Benefit Analysis Model for
Educational Program Management

Program objectives can be product-oriented and be specified by the degree of educational performances. For example, the program objectives are organized in a time frame in which they are matched with such factors as: (1) enrollment, (2) preparation and completion, (3) placement and advanced studies, which indicate immediate achievements, and (4) job satisfaction and economic benefits, which indicate long-range achievements. Furthermore, each of the program objectives is specified in measurable terms according to the target goals which it aims to achieve.

Program Outputs. Program outputs are the products or expected results from the program. They are often expressed in terms of results or impacts of the school system. The National Center for Educational Statistics (1973) classifies 58 different educational outcomes into three phases: (1) primary effects (product consumption and investment), (2) secondary effects (feedback from investment and consumption), and (3) tertiary effects (intergenerational impacts). Clemmer, Fairbanks, Hall, Impara and Nelson (1974) identify performance indicators, such as student test results and the number of students completing graduation requirements, and societal indicators, such as the employment rate of graduates (p. 3).

In this model, program outputs are defined as the actual attainments of predetermined objectives and target goals because these attainments are the desired outcomes which result from the educational program. Accordingly, program objectives and target goals are compared with actual achievements of enrollment, career preparation, program completion, placement, advanced study, job satisfaction, and economic benefits.

Student output units, such as the number of enrollments, student credit hours, program completers, and graduates are identified when

computing the unit costs of an educational program. The long-range goal of increased monetary benefits may be measured by students' earnings after completion of their program.

Program Costs. Program costs can be defined by amounts expended for operating the educational program at the local district or institutional level. By this definition, foregone income for the time of students while they are in the program are not counted in the costs of educational programs. Operating expenditures are to be analyzed on a one-year basis to determine annual cost expended for the program operation.

The expenditures for the operation of educational programs can be divided into direct costs and indirect supporting service costs. Direct costs of an educational program are defined as expenditures directly related to the program and classified as: (1) salaries, (2) employee benefits, (3) purchased services, (4) supplies and materials, and (5) capital outlay. Prorated expenditures for administrative and support services can be considered as indirect costs of the educational program. The indirect costs can include: (1) student support services, (2) instructional staff services, (3) general administrative services, (4) school administrative services, (5) business services, and (6) central support services (U.S. Office of Education, Handbook II, 1973, pp. 39-48).

When the analysis is concerned with comparing program costs with immediate program effectiveness, only operating expenditures are used. But students' opportunity costs should be added to the operating expenditures when the analysis attempts to compare program costs with long-range monetary benefits. The student opportunity costs may include their private costs such as tuition fees and book costs, and their foregone income while they are enrolled in educational programs.

Based upon information about program objectives, outputs and costs, the model purports to generate three kinds of cost-effectiveness/benefit measures: (1) program effectiveness, (2) cost efficiency, and (3) cost-effectiveness and performance ratios. Each of the measures is computed as follows:

Program Effectiveness and Benefits. Effectiveness is a measure of the extent to which an objective is achieved. Program effectiveness, which indicates a degree of program goal attainment, is made by dividing program outputs by target goals. A number of program effectiveness scores can be combined into an effectiveness index. A composite effectiveness index is made by adding all available effectiveness scores. Dividing the composite index by the number of scores provides an average effectiveness index. If effectiveness scores are weighted according to the priority of their program objectives, a weighted composite or average effectiveness index can be made using the same procedure.

As a long-range target goal, monetary benefits are measured by an income stream of students' future earnings after program completion. The sum of future incomes may be discounted at the given interest rate to determine the present value of the income. Increased income which is the result of training in the postsecondary educational program, for instance, can be determined by subtracting from the average annual income of the program completers the average annual income of high school graduates who are not enrolled in the postsecondary program. The present value of these increased incomes can be computed using the discount rate.

Cost Efficiency. Efficiency is a measure of the relationship between costs and short-term and long-term program outputs. Internal efficiency is measured by dividing a total actual cost by either the total number of

students enrolled in the educational program, student credit hours, or program completers. Each of the quotients is an actual unit cost of the program. If budgeted costs for the program are analyzed or standard costs are available, the actual unit cost may be divided by the budgeted or standard unit cost to determine a ratio of performance efficiency.

Furthermore, external efficiency can be measured by the relationship between student program costs and completers' future incomes. Comparing the student program costs with the stream of future incomes results in: (1) the net present value, (2) the cost-benefit ratio, and (3) the internal rate of return to the investment in the educational program.

The net present value of future incomes is the difference between the present value of costs, which are program costs plus student opportunity costs in the initial year, and the present value of increased incomes at the given discount rate. The cost-benefit ratio is measured by dividing the present value of increased incomes by the present value of costs. The ratio is greater or less than unity.

The internal rate of return is that interest rate which makes the present value of increased incomes equal to the present value of costs, or a sum of ratios of annual growth rates to the interest rates is equal to the ratio of the present value of costs to the increased incomes. These external efficiency measures result from the cost-benefit analysis of educational programs and are to be used as criteria for public investment in the program.

Cost-Effectiveness and Performance Ratios. The final product of the model is a cost-effectiveness ratio and a performance ratio. The cost-effectiveness ratio is measured by dividing one of the program effectiveness

indices by actual unit cost. The ratio indicates the degree of goal attainment per unit cost.

The performance ratio is generated from the division of program effectiveness indices by a performance efficiency index. This performance ratio indicates more or less than unity when using an average program effectiveness index. It is a precise measure of management performance by representing the relationship between program effectiveness and cost efficiency.

Management Systems and Cost-Effectiveness/Benefit Analysis

As a systems analysis, the cost-effectiveness/benefit analysis technique is related to the accountability, PPB, and MBO systems. The relationships of the technique with these systems are described in terms of three common elements which are fundamental to all these management systems.

Accountability and Cost-Effectiveness/Benefit Analysis. Accountability is defined in many different ways: as performance reporting, a technical process, a political process, or an institutional process (Levin, 1974, p. 364). Essentially, it establishes "who is accountable for what and to whom." Educational administrators are held accountable for improving program effectiveness and efficiency by students, legislators, and taxpayers to whom they should be able to report the answers to these seven interrelated questions: (1) What is to be achieved? (2) Who is responsible? (3) What was actually achieved? (4) What resources were used to achieve the results? (5) What techniques were available? (6) What steps were taken to get the intended results?, and (7) What will happen in the future? (Lessinger, 1977, p. 151).

From the management perspective, the accountability concept places emphasis on the attainment of objectives as well as on the allocation of resources. As a means of getting top results, an accountability system demands a careful specification of objectives, an assignment of responsibilities, and a subsequent measurement of achievements (Knezevich, 1973, p. 59). It is thought that such a system will enable a school district to reach acceptable levels of performance and continuously improve its services (DeMont & DeMont, 1975, p. 6). Before schools may be held accountable for results, each school must have a structure which allows it to monitor its own performance in terms of costs and results (Lessinger, 1977). For this purpose, the accountability system requires both the effectiveness and efficiency measures derivable from the cost-effectiveness/benefit analysis.

PPB System and Cost-Effectiveness Analysis. Cost-effectiveness analysis has significant applications to the PPB system. PPB, or as it is sometimes called, program budgeting, was originally developed for federal program management with emphasis on strategic planning and the role of analysis in the budgeting process. Fisher (1971) discussed three aspects of the PPB system: (1) the structural aspect, oriented primarily toward an end product or end objective, (2) analytical process considerations, for the examination of alternative courses of action, and (3) information system considerations, for evaluation and control.

To apply the PPB system to education, Knezevich (1973) developed the PPBADERS cycle of activities: (1) Planning, for clarifying goals, (2) Programming, for generating alternative approaches to goals, (3) Budgeting, for translating programs into fiscal requirements, (4) Anyzing, for

determining the cost-effectiveness of alternatives, (5) Deciding the best course of action, (6) Evaluating outcomes and relating each to prior expectations, and (7) Recycling, for feeding evaluative judgments into the system to begin a new and modified PPBADER cycle. This cycle concept not only shows the relationship of cost-effectiveness analysis to the PPB system, but also clarifies its role in evaluating and planning educational programs.

Thus, cost-effectiveness/benefit analysis is a useful component of the PPB system and increases its potential by providing decision makers with program effectiveness and cost efficiency measures in achieving the stated objectives.

MBO System and Cost-Effectiveness Analysis. The management by objectives (MBO) concept was originally developed by Drucker as a management technique to direct the vision and efforts of all managers toward a common goal. According to his book (1954), each manager should be responsible for developing the objectives of his unit as well as for participating in the development of the higher units' objectives. Furthermore, every manager should be able to measure his own performance and results against the stated goal, have sufficient information to measure his own performance, and receive it soon enough to make any changes necessary for the desired results (pp. 121-136).

Schrieber and Sloan (1970) viewed management by objectives as a management process by which work is organized in terms of achieving specific objectives by set times, and in which the superior and subordinate jointly:

1. Identify in writing major functional areas of responsibility for the subordinate, including objectives to be accomplished in terms of results, and
2. Determine how and by what time these standards should be achieved, so that the superior and the subordinate periodically evaluate progress (p. 20).

With primary emphasis on the management functions of planning and controlling, Morrissey (1970) devised a management by objectives and results (MOR) approach which consists of ten stages: (1) determining the baseline of work to be performed, (2) forecasting the future, (3) setting objectives to be achieved, (4) programming to follow in reaching objectives, (5) scheduling for objectives and programs, (6) budgeting to reach objectives, (7) establishing standards for effectiveness performance in achieving objectives, (8) determining actual versus planned performance, (9) taking corrective action toward performance improvement, and (10) achieving objectives. This process covers the accountability and PPB concepts by dealing with the planning and evaluation functions of management.

Knezevich (1973) examined MBO, first, from the behavioral scientists' viewpoint as a method of evaluating individual job performance, improving worker's motivation, and increasing people's sensitivity to one another; secondly, he examined it as a systems management technique which stresses specification of objectives and organization of resources toward their achievement. The latter concept of MBO is viewed as a subset of the PPB system and is a kind of accountability technique for holding people responsible for results (pp. 53-57). Thus, as a planning and control approach, an MBO system requires analytical techniques and measures for assessing performance achievements.

Relationship of the Four Concepts. The concept of accountability, in a broad sense, links the PPB and MBO system, both of which use analytical techniques to derive quantitative measures from cost-effectiveness analysis. There are three common elements to the four concepts. They are: (1) specified objectives and target goals, (2) resulting outputs, and (3) enumeration of costs. The relationship is diagrammed in Figure 2.

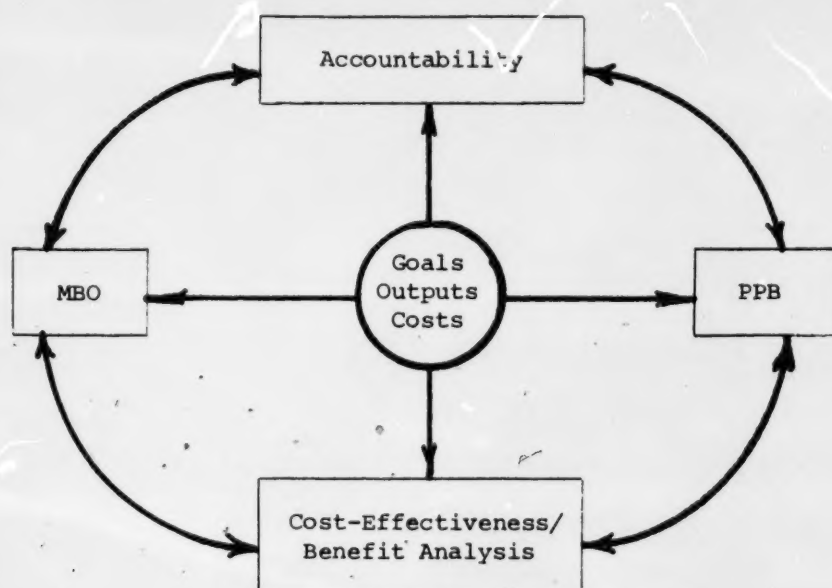


Figure 2

The Relationship of the Four Concepts of Accountability, MBO, PPB, and Cost-Effectiveness/Benefit Analysis

Each of the three elements may be described in measurable terms and quantified to compute the degrees of effectiveness, efficiency, and managerial performance for educational programs. Thus, specification of the three analytical elements and computation of three kinds of measures are extremely important in the application of PPB and MBO to educational institutions for the improvement of their management system.

Summary and Implications

Cost-effectiveness/benefit analysis is an analytical technique for assessing outputs of educational programs in relation to the program objectives and over the associated program costs. By definition, two concepts of cost-effectiveness analysis and cost-benefit analysis can be combined into a comprehensive model. The combination of these concepts eliminate conflicts in developing the technique and in its application.

Viewing the educational system as a product process, a cost-effectiveness/benefit analysis model has been developed to include three major components of: (1) determining program objectives and target goals in measurable terms, (2) assessing short and long-range program outputs, and (3) analyzing program costs. The relationships of three major components generate three kinds of measures: (1) program effectiveness, (2) cost efficiency, and (3) management performance measures for educational programs. The cost-effectiveness/benefit measures can be used in answering three related questions: (1) How effective are educational programs? (2) How efficient are the programs?, and (3) Do the programs perform in an effective and efficient manner? Thus, the measures will provide educational administrators with alternative criteria in the decision-making process.

The cost-effectiveness/benefit analysis model can be integrated into emerging management systems such as accountability, PPB system, and MBO system. It provides analytical techniques and quantitative measures which are necessary in developing management systems. The conceptual and technical procedures as developed in the cost-effectiveness/benefit analysis model

can be applied to planning, implementing, and evaluating educational programs and to improving a formulation of management systems for educational program operation.

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